

**STATE DOTS' PROFESSIONAL STAFFING CHALLENGES AND
PRACTICES FOR SUCCESSFUL DEVELOPMENT OF DESIGN
BUILD DELIVERY PROJECTS**

A Dissertation
Presented to
The Academic Faculty

by

Shiva Bahrami

In Partial Fulfillment
of the Requirements for the Master's Degree in the
Civil Engineering at Georgia Institute of Technology

Georgia Institute of Technology
May 2018

COPYRIGHT © 2018 BY SHIVA BAHRAMI

**STATE DOTS' PROFESSIONAL STAFFING CHALLENGES AND
PRACTICES FOR SUCCESSFUL DEVELOPMENT OF DESIGN
BUILD DELIVERY PROJECTS**

Approved by:

Dr. Baabak Ashuri, Advisor
School of Civil and Environmental Engineering
Georgia Institute of Technology

Dr. Adjo Amekudzi-Kennedy
School of Civil and Environmental Engineering
Georgia Institute of Technology

Dr. Eric Marks
School of Civil and Environmental Engineering
Georgia Institute of Technology

Date Approved: April 25, 2018

To my parents

ACKNOWLEDGEMENTS

I would like to especially thank my thesis advisor Dr. Baabak Ashuri from School of Civil and Environmental Engineering at Georgia Institute of Technology for his valuable guidance and continuous support. Without his inputs and encouragements, this research could not have been successfully conducted.

I would also like to thank the experts in State Department of Transportation who were involved in the validation of survey for this research project, especially Mr. Darryl VanMeter, GDOT Assistant P3 Division Director/State Innovative Delivery Administrator.

I would also like to acknowledge Dr. Adjo Amekudzi-Kennedy and Dr. Eric Marks from School of Civil and Environmental Engineering as the committee members; I am gratefully indebted to their valuable comments on this thesis.

Finally, I must express my very profound gratitude to my parents and to my brother for providing me with unfailing support and continuous encouragement through the process of researching and writing this thesis. This accomplishment would not have been possible without them.

Thank you.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF SYMBOLS AND ABBREVIATIONS	ix
SUMMARY	x
CHAPTER 1. Introduction and literature review	1
1.1 Background and Literature Review	1
1.2 Objective	5
CHAPTER 2. Research Methodology	7
2.1 Refinement of Survey Questions	8
2.2 Interview Questions Preparation and Interviews	8
2.2.1 Selecting State DOTs	8
2.2.2 Preparing Interview Questions	9
2.2.3 Conducting Interviews	10
2.3 Collection of Documents from State DOTs	10
2.4 Analysis of Document Content	11
CHAPTER 3. Identified Challenges Related to Professional Staffing of Design-Build Delivery Programs in State DOTs	12
3.1 Staffing Needs	14
3.1.1 Growing Needs to Deliver More Projects, Especially More Complex Projects and Megaprojects, Using DB Project Delivery	14
3.1.2 Sudden Need for Staffing Growth in the DB Program	14
3.1.3 Limited Internal Expertise in IPD, Especially in the Early Stage of Adoption	15
3.1.4 Justification for Hiring Fulltime Staff for Alternative Delivery Program	15
3.1.5 High Turnover Rate among State DOT Innovative Delivery Subject Matter Experts	16
3.1.6 Substantially Greater Staffing Needs for Megaprojects that often Require a Dedicated Program in the State DOT	16
3.2 Organizational Issues: Challenges Related to Organizational Structure, Policies and Governance	17
3.2.1 Consistency in the Management, Procurement, and Oversight of Design-Build Projects	17
3.2.2 Concerns of the Professional Engineers in the State Government	18
3.3 Issues Related to Acquire Required Skillset- Training Needs	19
3.3.1 Limited Resources to Learn Best Practices from Other State DOTs and the Design-Build Industry	19
3.3.2 Succession Planning for the State DOT's Subject Matter Experts	19

3.3.3	Required Non-traditional Skillset for the Innovative Delivery Staff	20
3.3.4	Difficulty in Attracting Internal State DOT Staff to Join the DB Management Team	21
3.4	Challenges of Using Consultants as Owner's Representative	21
3.4.1	Identification of the Appropriate Model to Utilize Consultants	21
3.4.2	Limited Financial Capacity to Afford Expensive Rates of Some Consulting Firms	22
3.4.3	Issues Related to Procurement of Owner's Consultants to Help the State DOT in the Innovative Delivery Program	23
3.4.4	Familiarity of Consulting Firms with the State DOT's Approach for Project Development	23
3.4.5	Conflict of Interest (COI) for Owner's Consultants	23
3.4.6	Concerns of the State Engineering Consultant Industry	24
3.4.7	Development of a Proper Performance Measurement System to Keep Track of the Performance of the Owner's Consultant	25
3.4.8	Issues Germane to Disadvantaged Business Enterprises	26
CHAPTER 4.	Identified Strategies to Enhance Professional Staffing of Design-Build Delivery Programs	27
4.1	Models of Office of Innovative Delivery: Organizational Structuring and Professional Staffing	28
4.2	Main Roles and Responsibilities of the HQ Office of Innovative Delivery	31
4.3	Involvement of District Offices in Delivery of Design-Build Projects	34
4.4	Training and Staffing Strategies and Preferred Skillsets	48
4.5	Utilizing Consulting Firms to Assist the Owner	55
4.5.1	Prequalification, Licensing Requirements, and Selection Criteria for Evaluating Consulting Firms (Licenses, Requirements)	55
4.5.2	Selection Process	57
4.5.3	Contracting and Payment Methods	58
4.5.4	Assigned Tasks to the Owner's Consulting Firm	59
4.5.5	Key Personnel and Respective Required Skillsets and Qualifications for Owner's Consultants	67
4.5.6	Conflicts of Interest (COIs)	68
4.5.7	Disadvantaged Business Enterprise (DBE)	69
4.5.8	Performance Metrics	71
CHAPTER 5.	Summary of the Study	73
REFERENCES		75

LIST OF TABLES

Table 1	- Different Roles that HQ Office of Innovative Delivery Plays in Delivering Design-Build Projects in Different State DOTs	33
Table 2	- Tasks Performed by District Offices to Assist the HQ Office of Innovative Delivery in Different State DOTs	37
Table 3	- A Summary of Different Strategies Utilized by State DOTs in Enhancing the Awareness of the Internal Staff about Design-Build and Developing Skilled Workforces to Staff Design-Build Program	49

LIST OF FIGURES

Figure 1	- An Overview of the Research Methodology	7
Figure 2	- An Overview of Different Categories of Challenge	13
Figure 3	- An Overview of Design-Build Programs in Different State DOTs	29
Figure 4	- Number of Full Time Equivalents (FTEs) Dedicated to Office of Innovative Delivery in Different State DOTs	30
Figure 5	- Variations of District Offices in Delivery of Design–Build Projects	34

LIST OF SYMBOLS AND ABBREVIATIONS

DOT	Department of Transportation
DB	Design-Build
P3	Public Private Partnership
HQ	Headquarter
RFQ	Request for Qualifications
RFP	Request for Proposal

SUMMARY

Attracting and retaining talented staff has always been a challenge for state DOTs. When it comes to innovative project delivery, the problem becomes more apparent as a unique set of project management skills are required to perform design–build services. Evaluating the best practices with respect to staff education and training for design–build roles and responsibilities can be helpful to strengthen the design–build workforce inside the state DOT.

The overarching objective of this research project is to study the practices in organizational structuring and professional staffing of the innovative delivery units in several state DOTs across the nation that are actively utilizing design–build in order to:

1. Identify and analyze the latest developments and trends in project leadership staffing needs for innovative delivery programs among state DOTs across the nation;
2. Identify and analyze major challenges and barriers faced by innovative project delivery units to fulfill project leadership staffing needs;
3. Identify and analyze the organizational structure of innovative project delivery units in state DOTs with an active design–build programs;
4. Identify and analyze the skillsets, experience, and professional backgrounds of the PMs (Project Managers) in the innovative delivery units;
5. Identify the list of skills, type of expertise and key professional leadership staffing requirements for various project delivery responsibilities throughout the project lifecycle;

6. Identify and analyze the organizational structure and role of district offices in accomplishing various project delivery tasks and responsibilities;
7. Identify and analyze state DOTs' preferred model for innovative project delivery (e.g., outsourcing to consultants, relying on in-house resources, sharing resources with the other involved offices, or a combination of those approaches), and,
8. Identify best practices in workplace training, knowledge retention and sharing, and knowledge management utilized by the innovative delivery units.
9. Identify and investigate the main issues and practices related to the effective use of owner's consultants or representative (at either program level or project level) in providing services to the design-build program.

Several challenges for organizational structuring and professional staffing of design-build programs are identified by State DOTs' subject matter experts who were surveyed by email and interviewed by phone as the following. Moreover, differences among state DOTs on how to respond to the challenges of professional staffing for innovative delivery programs and strategies to enhance professional staffing of innovative delivery programs are identified.

INTRODUCTION AND LITERATURE REVIEW

1.1 Background and Literature Review

The need for infrastructure projects is inevitable because of the aging infrastructures, required regional development, population growth and people's transport needs (Pakkala 2002). Public transportation agencies all over the world are trying to keep up with the growing needs. These needs are great incentives to utilize innovative project delivery methods for project procurement in more economically stable ways (Pakkala 2002). State DOTs throughout the United States are also increasingly utilizing design-build to deliver a significant portion of their annual construction budgets. For instance, Georgia DOT (GDOT) has awarded 22 design-build projects worth over \$1.1 billion since 2008 (GDOT 2015). In 2012, the Georgia legislature approved an increase in the level of using design-build for transportation projects by raising the cap to 50% (in dollars) of the total amount of construction projects awarded in the previous fiscal year and provided the flexibility for GDOT to utilize the best-value selection for procurement of design-build projects.

Moreover, since the introduction of the special experimental project 14 (SEP-14) in 1990, the Federal Highway Administration (FHWA) has encouraged state departments of transportation (DOTs) to utilize innovative delivery approaches, such as design-build (DB), for delivery of highway projects (FHWA 2015).

These emerging trends and incentives for using innovative delivery approaches have resulted in several challenges to state transportation agencies in their quest to meet

new requirements to construct, repair and enhance roadway infrastructures. One of these challenges is the selection of agency staff and other workforce needs. (Taylor and Maloney 2013)

For instance, NCHRP Synthesis 450- Forecasting Highway Construction Staffing Requirements - shows that between 2000 and 2010 the total lane-miles in the systems managed by STAs increased by an average of 4.1%, whereas the in-house STA personnel available to manage these systems decreased by an average of 9.78% over the same time period. In addition, approximately 86.1% of respondents to the survey conducted in this study note that by any measure STAs are doing more work with fewer agency employees than they were 10 years ago. (Taylor and Maloney 2013)

Moreover, attracting and retaining talented staff has always been a challenge for state DOTs when it comes to DB project delivery. Competent project managers (PMs) are required to continue the success and expansion of the design–build delivery programs. The problem becomes more apparent as a unique set of project management skills (e.g., leadership, technical, managerial, financial, and procurement) are required to perform design–build services. These skills often require project-related experience in alternative project delivery (e.g., conceptual estimating, design management, financial analysis, team building, and quality assurance) that may be difficult to find in graduates of most engineering and project management schools around the nation (Gransberg and Molenaar 2008). Therefore, state DOTs not only are dealing with more workload with less workforce, but also requiring a specific pool of skillsets to manage the existing workload.

These existing needs indicate that the allocation of human resources is critical in maintaining and improving the nation's roadway infrastructure system. Although the variable nature of construction projects' volume, type, and location can make estimating staffing requirements for both the short and long term difficult, evaluating the adequate construction staffing is critical to the cost, schedule, quality, and safety performance of highway construction projects (NCHRP, Synthesis 450). As a result of these challenges and based on the study findings, several state DOTs have devised dedicated units or offices for delivery of design-build projects, outsourced some of the roles that were out of the scope of agency's employees to consultant companies, or replaced some of the agency's employees with consultant companies' personnel. State DOTs need to understand the new roles and positions that the Office of Innovative Delivery introduces, such as conceptual estimator or quality assurance specialist, for design-build projects. The dynamics of change should be studied to clarify how design-build roles differ from conventional roles and responsibilities (Warne 2003).

In addition, the role of consulting firms as owner's representatives in design-build project delivery and also best practices in procurement of consulting resources (e.g., types of programmatic agreements used by state DOTs as a means to deal with increased workload) should be clearly identified. Some state DOTs distinguish between the roles of design-build consultants who perform program management services and those who provide general engineering services. Among the main objectives of this study are understanding this difference and characterizing the main functions that consulting firms as owner's representative perform for the state DOT..

In most cases, the decision to assign a portion or all of either program management or general engineering roles to an owner's representative (owner's rep) unique to the state DOT and the specific activity. Substantial variations occur among the states and the activities assigned to owner's rep when it comes to procuring different services. The type of contractor, method of procurement, and payment basis are all functions of the unique characteristics of the outsourced activity to owner's rep (NCHRP 313- Behrens et al 2003). As an example, there are occasions that either the legislative or executive branches of state government directly mandate outsourcing, whereas the more common scenario is that they try to limit or reduce the number of state employees that eventually results in a mandate to assign a portion of the work to consulting firms who have owner's rep roles (Warne 2013).

NCHRP Synthesis 246 study (1997) found that reasons for assigning a portion of work to owner's rep firms were most frequently related to either increased workloads or decreased staffing levels. Much variation was also found among states in areas such as the procedures for assigning the roles, pre-award and prequalification processes, use of alternative bids, and value engineering. The most common benefits cited by respondents to the survey about the utilization of consulting firms were the ability to supplement in-house staffing levels in meeting workloads and schedules, the ability to use specialized skills or equipment available in the private sector, and cost savings (Witthoford 1997). However, the use of consulting firms as owner's rep has not been without challenges. Therefore, in this study, the researchers (author and academic advisor) investigate the main issues and practices related to the effective use of owner's consultants in providing services to the design-build program.

Whether it is the agency's internal or external staff (that were provided by owner's rep), evaluating the best practices with respect to staff education and training for design-build roles and responsibilities can be helpful to strengthen the workforce inside the state DOT. DOTs are dealing with issues related to their workforce and the most critical challenge for them is figuring out how to equip state employees with the skills necessary to operate efficiently in this intense era of needs for infrastructure construction (Warne 2005), simultaneous with the significant loss of personnel to retirement (Amekudzi-Kennedy et al., 2016). Therefore, it is necessary to implement an appropriate training program for the DOT to prepare the Office of Innovative Delivery workforce for design-build dynamics and new sets of roles and responsibilities. Training should include not only contracting agency personnel but also consulting engineers and construction contractors who will perform various tasks for the state DOTs in design-build and public-private partnership (P3) projects.

1.2 Objective

The overarching objective of this research project is to identify and analyze challenges and strategies that state DOTs are utilizing when it comes to developments and trends in project leadership staffing needs for innovative delivery programs, fulfilling project leadership staffing needs, organizational structure of design-build project delivery units, required skillsets and experience of the PMs, organizational structure and role of district offices in accomplishing various project delivery tasks and responsibilities, preferred model for design-build project delivery (e.g., outsourcing to consulting firms, relying on in-house resources, sharing resources with the other involved offices, or a

combination of those approaches), and finally best practices in workplace training, knowledge retention, sharing and management utilized by the design-build delivery units.

RESEARCH METHODOLOGY

Identifying and synthesizing the challenges and strategies of staffing needs of Design-Build programs across the state DOTs requires careful and detailed investigation because of its multi-faceted and complicated nature. Therefore, this study used a combination of methods to first define the areas that should be studied, then collected more data and content in those areas which led to identification of the professional staffing practices of Design-Build delivery projects. Subsequently, several steps were taken to achieve the objective of this research (Figure 1). A detailed explanation of these steps is presented below:

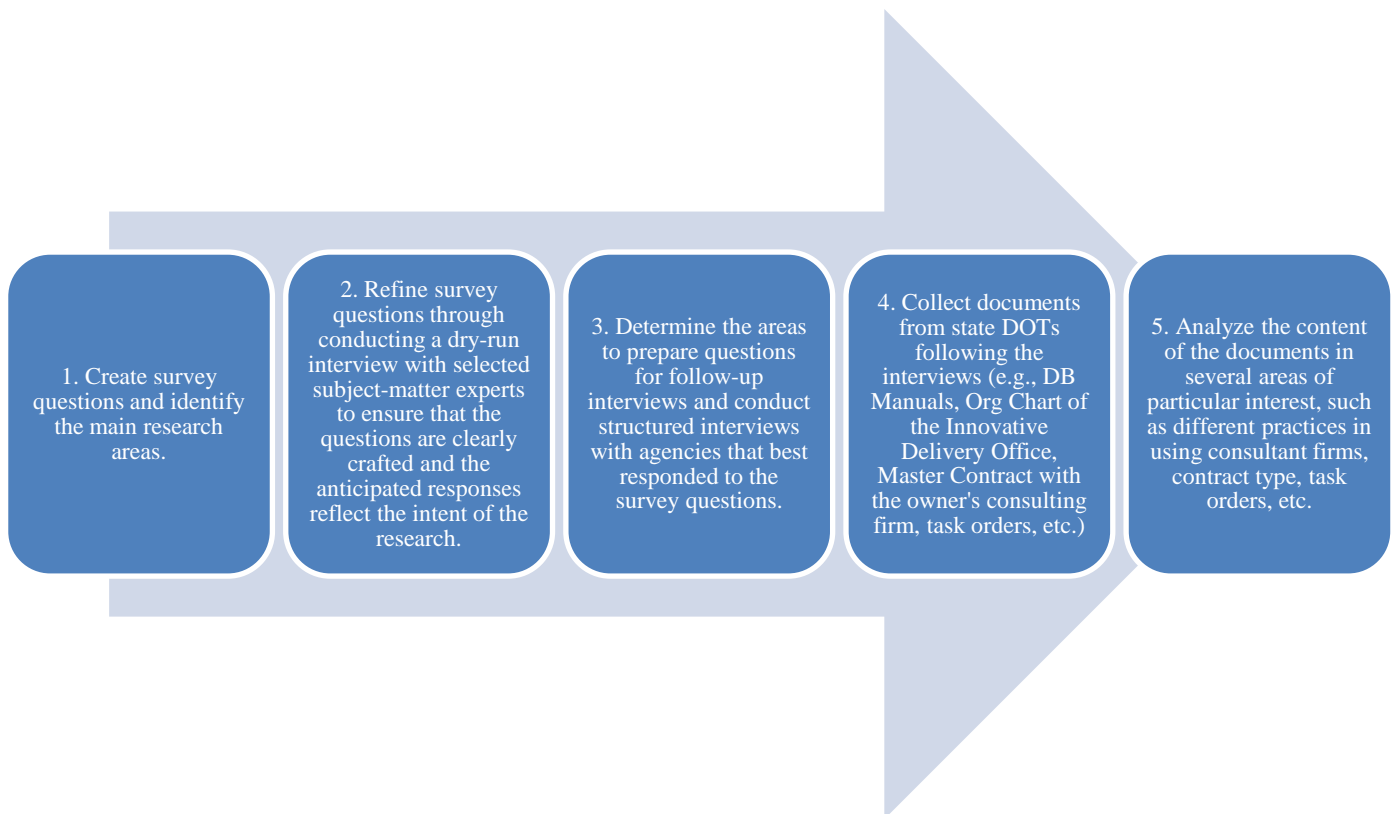


Figure 1 - An Overview of the Research Methodology

Literature Review, Development of Survey Questions and Identification of Main Areas of Research Initially, the research team carefully studied the existing literature, especially the research reports investigating the staffing needs and requirements in highway construction industry. Then based on the collected information and previous studies, researchers prepared a set of questions in major areas related to professional staffing that represent challenges and needs of the state DOT in delivering design–build projects. An email survey was prepared and distributed among state DOTs’ innovative delivery office administrators. The major areas of study used in the survey were the following:

- Position of the Office of Innovative Delivery in the state DOT’s organizational chart
- Formation and internal structure of the Office of Innovative Delivery
- Changes that the Office of Innovative Delivery has brought to the state DOT
- The role of consultants and outsourcing in design–build project delivery
- Training and skills development programs

1.3 Refinement of Survey Questions

Researchers sent the survey to a few design-build subject-matter experts in order to validate and refine the questions and make a final decision on the best questions to use in the survey to get the best results. They then used the refined set of questions to gain and collect information about the current practices in professional staffing of state DOTs in design-build offices. The email survey was sent to 33 state DOTs in the United States with active design–build programs, of which 15 state DOTs provided answers.

1.4 Interview Questions Preparation and Interviews

1.4.1 Selecting State DOTs

Following the analysis of the survey results, the researchers identified the following state DOTs for follow-up interviews: Colorado DOT, Florida DOT, Maryland State Highway Administration, Massachusetts DOT, Minnesota DOT, Virginia DOT, Utah DOT, Caltrans, North Carolina DOT, Texas DOT, Georgia DOT, Washington State DOT, New York State DOT, Missouri DOT and Louisiana DOT.

The selection was made based on the quality and depth of answers to the survey questions, as well as expressed interest by the respondents in participating in the following research steps.

1.4.2 Preparing Interview Questions

The research team used more detailed questions for the interview phase to better understand the practice of staffing among state DOTs. The areas of focus for the interview phase were related to the following:

- Skillset of the staff in the innovative delivery office
- Training and education programs
- Tasks that are assigned to consultant firms
- Roles and responsibilities of every involved entity (headquarters [HQ] office, district offices, and consulting firms)
- Models of HQ offices and district offices
- Tasks that are conducted inside the Office of Innovative Delivery
- Involving smaller firms in consulting tasks
- Whether they implement consultant firms on program level or on project level

- Type of contracts (including basis of reimbursement, indefinite delivery/indefinite quantity [ID-IQ], disadvantaged business enterprise [DBE] utilization, etc.)
- Skillset/qualifications of the proposed staff by consultant companies
- Selection process and selection criteria of selecting the firms for different tasks

The researchers refined the interview questions through conducting dry-run interviews with a few subject-matter experts in design–build organizations to ensure that the questions would help collect the information they intended to retrieve from the state DOT officials.

1.4.3 Conducting Interviews

After refining and finalizing interview questions, the research team conducted interviews with the selected heads of the offices of design–build delivery, other professionals who have major roles in the offices of design–build delivery, or owner’s consultants that represent the offices.

1.5 Collection of Documents from State DOTs

Participants in the interview provided several internal documents that contain valuable information regarding the organizational structure of their design–build programs. Also, they shared copies of their contracts with the owner’s consulting firms. These documents explain how the state DOT handles the inflow of design–build projects and describe the augmentation model that the state DOT uses to supplement its internal staff through outsourcing preliminary engineering tasks to the consulting firms. These documents included, but were not limited to, design–build manuals; organizational chart

of the Office of Innovative Delivery, as well as the description of the related roles and responsibilities; organizational charts of mega projects; innovative delivery methods presentations or related materials of current practice; request for qualifications/request for proposals (RFQs/RFPs) for hiring owner's representative or consultant company; master agreement; and sample of task order contracts.

1.6 Analysis of Document Content

Content analysis was performed on the resources provided to identify and characterize different state DOTs' practices in utilizing consultant firms, managing conflicts of interest, addressing DBE involvement, assigning tasks to the consultant firms, and describing staff qualifications and needs. The content analysis helped the researchers gain knowledge of the language of contracts in different DOTs, how they exclude or include consultant firms in different areas and tasks, and the qualifications or required skillset of the staffs and the assigned roles and responsibilities to different parties and employees.

IDENTIFIED CHALLENGES RELATED TO PROFESSIONAL STAFFING OF DESIGN-BUILD DELIVERY PROGRAMS IN STATE DOTS

Subject Matter Experts of Design-Build programs of state DOT who were actively engaged in the research process identified several challenges for professional staffing of Design-Build programs. These challenges are either internal –such as challenges regarding their in-house staff and their available resources - or external such as challenges that they are facing when they use consulting firms. The researchers (author and academic advisor) have categorized the challenges based on the interview results. **Figure 2** shows the in-house challenges and also the challengers related to outsourcing.

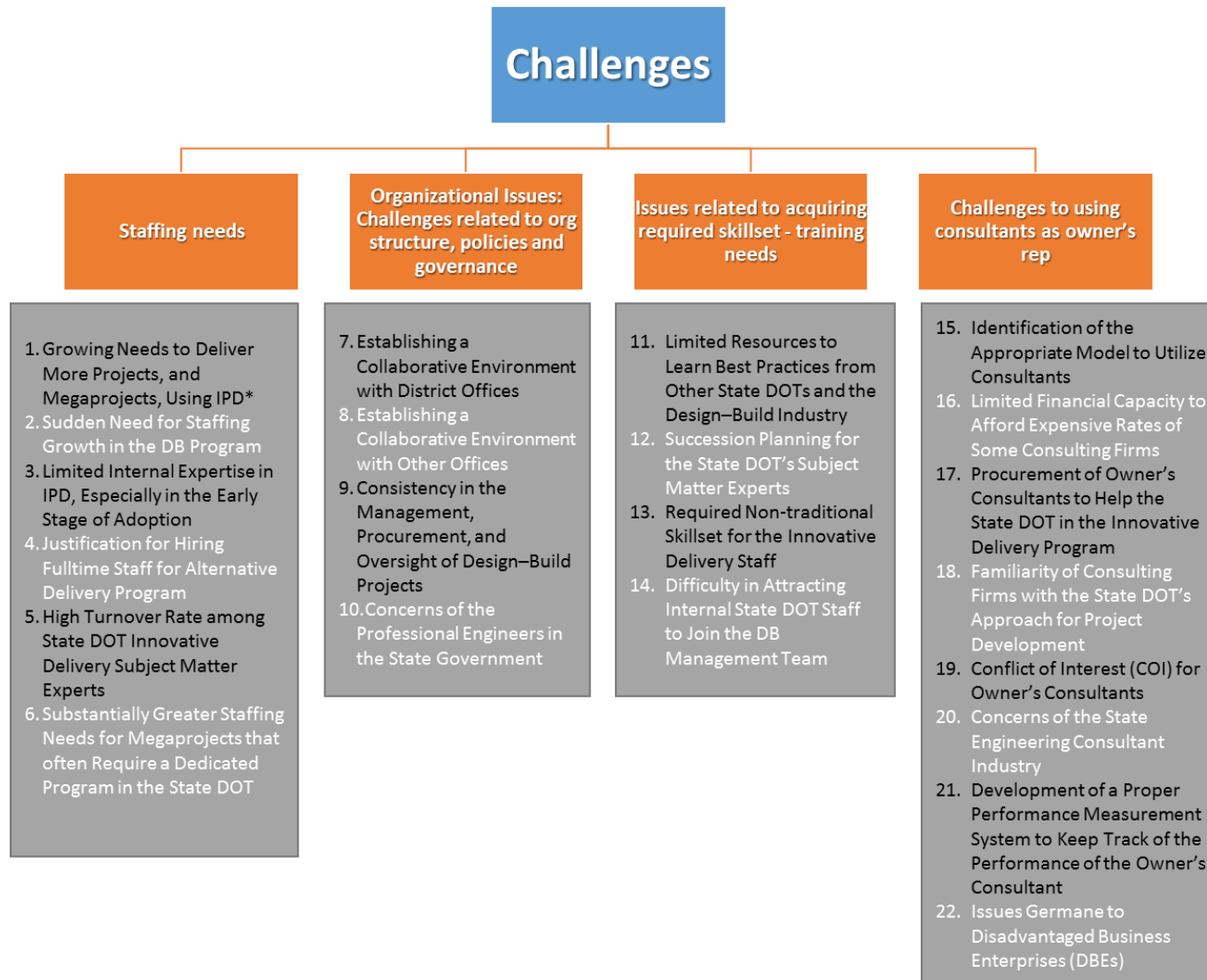


Figure 2 - An Overview of Different Categories of Challenge

1.7 Staffing Needs

1.7.1 Growing Needs to Deliver More Projects, Especially More Complex Projects and Megaprojects, Using DB Project Delivery

State DOTs across the nation face the rising challenge of delivering more complex projects with substantially larger scopes and budgets. Typically, and if allowed in the state procurement law, state DOTs turn to innovative project delivery such as DB to develop complex and large projects. DB project delivery demands a new set of expertise in design, construction, procurement, contracting, and advisory and project oversight. Therefore, new challenges are introduced to the state DOT in terms of organizational structure and professional staffing as changes that should be made in the regular way of doing business in the Department. The state DOT needs to rethink how it should utilize its own expertise, train its resources, and use external support to deliver complex projects.

1.7.2 Sudden Need for Staffing Growth in the DB Program

Staffing a couple of (or a few) projects per year may not be too problematic for the state DOT but staffing several projects on short notice is a much greater challenge. This issue, especially, becomes challenging when the state DOT is under pressure from the legislature to deliver a minimum number of design–build projects or minimum dollar amount in design–build programs per annum. Based on the interview results, too much growth in a short period of time is typically becoming problematic in terms of finding reliable and knowledgeable workforces from inside the department to staff the projects. Planned growth for design–build helps the state DOT manage workforce issues more efficiently. State DOTs that frequently start and stop their design–build programs often

struggle the most to efficiently staff their design–build projects, as they sometimes lose talent and expertise to the private sector and do not capitalize on the gain that can be made through learning-by-doing and economies of scale. A well-planned and stable design–build program can handle growth much better through providing the needed skilled workforce for the growing number of projects.

1.7.3 Limited Internal Expertise in IPD, Especially in the Early Stage of Adoption

Design–build delivery is completely unlike the traditional design–bid–build project delivery model that has been utilized for many years in state DOTs across the nation. Especially in the early stage of adopting the alternative delivery methods, state DOTs have struggled with the change as they lack the required expertise and experience in innovative project delivery. The main challenge is how to establish an innovative delivery unit and professionally staff the office with the existing DOT project management staff and technical professionals to achieve the desired outcomes promised by design–build method. Typically, state DOTs began their efforts by establishing a separate dedicated unit to handle innovative delivery projects (initially with delivering a pilot program) in parallel to other regular projects in the state. Some state DOTs, such as Maryland State Highway Authority (MDSHA) tried to enhance a successful organizational model for a substantially large design–bid–build project and modified the model to deliver its first design–build megaproject. The transition, however, was not without challenges.

1.7.4 Justification for Hiring Fulltime Staff for Alternative Delivery Program

Since the flow of design–build projects in some state DOTs may not be constant year by year, it is not easy to justify the expansion of alternative delivery programs as there

is a considerable uncertainty in some state DOTs about the longevity of design–build program. This is especially challenging for state DOTs that have considerable uncertainty in the legislative environment with a sunset put on the design–build legislation. Also, the Office of Innovative Delivery competes with several other offices in the state DOT for hiring additional staff, which makes the justification particularly difficult. A stable legislative environment with an appropriate plan for growth provides an opportunity for the Department to justify strategic hires for the design–build program as a long-term investment in human resources.

1.7.5 High Turnover Rate among State DOT Innovative Delivery Subject Matter Experts

Maintaining the talent in the design–build office for a long period of time is difficult. Considering the required expertise in managing alternative delivery projects, design–build experts in state DOTs tend to be closer to the retirement age. Also, consulting firms are very interested in offering top dollars to hire design–build experts from state DOTs.

1.7.6 Substantially Greater Staffing Needs for Megaprojects that often Require a Dedicated Program in the State DOT

Design–build project management is not the only discipline needed to effectively run the innovative delivery program. A wide range of disciplines should be utilized to deliver megaprojects. Megaprojects have substantially complex issues germane to environmental studies, right-of-way (ROW) acquisition, utilities relocation, roadway and bridge design, etc. during the preliminary engineering phase of the project. It is often difficult for the Office of Innovative Delivery to rely on the other offices to complete these

tasks in an expedited schedule, as is always desirable in design–build projects. In this sense, the Office of Innovative Delivery acts as a miniature DOT to handle most of the required tasks outside the help of other offices in the Department. Engineering consulting firms are currently utilized as owner’s consultants to assist the Office of Innovative Delivery to perform various tasks related to the preliminary engineering phase of the project. Some state DOTs have an opportunity to hire key technical professionals as part of the innovative delivery staff to reduce the reliance of the Office of Innovative Delivery on outside consultants (e.g., bridge design and environmental specialists). Regardless of the choice that the office has to make to address the technical aspect of megaproject development, finding the right professionals in different areas who are also familiar with the dynamics of design–build project delivery is not easy at all and represents a significant hurdle for staffing the Office of Innovative Delivery.

1.8 Organizational Issues: Challenges Related to Organizational Structure, Policies and Governance

1.8.1 Consistency in the Management, Procurement, and Oversight of Design–Build Projects

Considering limited staff in DB offices, it is a great challenge for the Department to ensure consistency across all DB projects in the state. For instance, district offices may need significant support for DB projects during letting, but the HQ office cannot be actively involved with those projects due to the staffing limitation. The HQ office or the district offices turn into consulting firms to represent the owner in tasks such as design oversight and construction administration. This practice has been helpful, but even though these

consulting firms are experienced, they often review too much details or are otherwise inconsistent. The design–build industry is interested in working with the state DOT on a common set of procedures and policies across the entire program all over the state. Establishing a unified model is also useful for all the disciplines required in delivering design–build programs, e.g., structural design review and quality assurance/quality control (QA/QC). Dedicated subject matter experts assigned to the design–build program can be considered as a strategy to not only enhance consistency but also reduce external consulting cost for the Department. It is also desirable to streamline developing procurement documents (RFQs and RFPs) for simple design–build projects.

1.8.2 Concerns of the Professional Engineers in the State Government

Over the past two decades, some state DOTs have faced reluctance and sometimes opposition from their government engineers unions or related organizations in implementing design–build programs. These organizations have argued that the growth of design–build sends a substantial amount of engineering works to the outside agency, and this outsourcing eventually leads to less demand for the state engineers. Although these claims were not justified (Gransberg and Molenaar 2008) they represent challenges for the Office of Innovative Delivery to justify the use of consulting firms as owner’s representatives in design–build programs. Finding the right balance between the utilization of internal staff and the use of consultants is a problem for some state DOTs that struggle to justify alternative contracting methods for the public and the state legislatures.

1.9 Issues Related to Acquire Required Skillset- Training Needs

1.9.1 Limited Resources to Learn Best Practices from Other State DOTs and the Design–Build Industry

For the state DOTs general resources may be available through the Federal Highway Administration, but each state DOT faces a challenge on how to best customize these training modules based on its unique needs and conditions. Engaging in different forums and committees at the regional and national levels has been an appropriate strategy to exchange lessons learned and identify best practices from peer colleagues in the other state DOTs and the design–build industry. However, an effective engagement requires substantial investment of time and resources from a group of dedicated state DOT practitioners, which may be difficult to justify to the upper management. Overall, defining a successful roadmap for implementation is a major barrier that state DOTs need to overcome to create a sustaining innovative delivery program.

1.9.2 Succession Planning for the State DOT's Subject Matter Experts

One of the major challenges that almost every state DOT is facing is succession planning for the head of their Office of Innovative Delivery and its senior project managers. The head of the design–build office has a critical position as the most knowledgeable subject matter expert in charge of leadership, advising, and support for the rest of the group. Also, as the amount of design–build work ramps up there is a pressing need for at least an assistant to the head of the office to manage different projects in various phases throughout the state. This issue was particularly highlighted by the MnDOT design–build program, as

their program needs to justify the funding request for the succession planning considering the volatility in the number of design–build projects from one year to another.

1.9.3 Required Non-traditional Skillset for the Innovative Delivery Staff

Design–build project managers need different skillsets than PMs of the traditional design–bid–build projects, which makes finding the right candidates challenging. A design–build PM needs to interact with a wide range of stakeholders from different backgrounds. Design–bid–build PMs are in charge of contract administration for a construction contract and, therefore, primarily deal with highway contractors. Design–build PMs need to be comfortable interacting with design consultants, as well, that demand them to be multidisciplinary-proficient. Design–build PMs need to be strong in a particular discipline but should appreciate the contributions of the other disciplines to the project (i.e., T-shaped skillset). Project managers need to know the design–build legislations and policies; understand the difference in the dynamics of the innovative project delivery; have the ability to interact with the FHWA representatives, engineering design consultant firms, design–builders, and several other stakeholders; and try to reduce the conflicts as much as possible. Soft skills, especially communication skills, are absolutely critical for the success of a design–build PM, as great PMs are diplomatic in nature and can protect the owner’s interest without damaging the good relationships between the state DOT and the design–build industry. Finding a candidate with the right personality is more important for some state DOTs than just the technical skillset, and this makes it difficult for government agencies to find candidates with these qualifications.

1.9.4 Difficulty in Attracting Internal State DOT Staff to Join the DB Management Team

It is usually perceived that the workload of the innovative delivery office is more than that of the traditional delivery method due to the nuance of managing complex design–build projects and interacting with a large number of stakeholders engaged in the design–build contract. As an evolving project delivery system, design–build PMs learn new things every day and need to frequently reach out to their peers in other state DOTs and subject matter experts in the design–build industry to get updates. Such a demanding position might be attractive for some DOT professionals, but many of the DOT engineers or construction managers may not be interested in accepting the challenging position, especially when they recognize that the pay rate is not necessarily higher than other traditional positions in the Department. This issue represents a challenge for the head of the design–build program to find the right candidates for the project management position. Often, nonmonetary incentives, such as training opportunities and a flexible job description, should be used to motivate the state DOT engineers and managers to join the design–build team to make an impact on the way the Department conducts its business.

1.10 Challenges of Using Consultants as Owner’s Representative

1.10.1 Identification of the Appropriate Model to Utilize Consultants

The major challenge for acquiring consulting professional expertise in the Office of Innovative Delivery is how an owner’s representative should look like to truly act in the best interest of the owner. The Office of Innovative Delivery may need a wide range of skills to perform various tasks throughout different phases of the project development. The Office of Innovative Delivery needs to conduct a tradeoff analysis to decide whether many

of these tasks should be combined under a program management umbrella contract or the office should bring in multiple consulting firms to perform these tasks. Utilization of a large consulting firm as a one-stop shop is helpful as it minimizes the need for issuing multiple contracts for different services, provides consistency in the approach used across a portfolio of projects, and offers efficiency in the delivery of various services. However, the selection of a single firm may reduce opportunities for other consulting firms in the market to participate in the state design–build program, and the required workload might be beyond what a consulting firm is normally able to provide. Using a single firm may also limit the state DOT’s choice to utilize the best firm in each discipline. The Office of Innovative Delivery needs assistance in making a decision about the right organizational model for the design–build program or an individual project, as the decision depends on several internal and external factors, such as available internal resources, the local design–build consulting industry conditions, scheduling constraints, funding limits, etc.

1.10.2 Limited Financial Capacity to Afford Expensive Rates of Some Consulting Firms

Considering the complexity of some design–build projects, the state DOT may require a unique set of skillsets that may be expensive to acquire. For instance, legal and financial advisors typically charge high rates for their services in P3 projects. Also, resolving unique design and construction challenges may require hiring a specialized consulting firm with a substantially higher rate compared to regular consulting firms. Justification of the high pay rates that are outside the Department’s regular pay range to consultants is challenging for the innovative delivery office.

1.10.3 Issues Related to Procurement of Owner's Consultants to Help the State DOT in the Innovative Delivery Program

Acquiring consulting services can be challenging, especially for an inexperienced state DOT that may not know what it does not know about the design–build program. An owner needs to clearly specify the areas that it needs help with. Defining the end goals and performance expectations can be problematic for unique and complex projects when the state DOT has no experience in delivering similar projects. Some state DOTs use a separate advisory consulting firm to assist the Office of Innovative Delivery with conducting capability assessment, identifying gaps in expertise, defining the areas where the design–build office needs assistance, and drafting the request for qualifications to hire owner's program management consulting firms to perform the required tasks.

1.10.4 Familiarity of Consulting Firms with the State DOT's Approach for Project Development

Staff in some state DOTs knows how the Department works and how other state agencies work but may not have experience with design–build, and the state, typically, does not have time for training. On the other hand, consultants know the design–build process but do not know how the Department or the state agencies work. Finding a delicate balance is a great challenge for these state DOTs.

1.10.5 Conflict of Interest (COI) for Owner's Consultants

Generally speaking, owner's consulting firms and their key sub-consultants that assist the innovative delivery office in important tasks during the preliminary engineering

phase of the project are not allowed to participate in any design–build teams competing on the project, as these consulting firms have an advantageous position over the other firms. Some state DOTs even go a step farther and limit the participation of owner’s consulting firms at the program level and do not let the owner’s program management consultant be on any design–build projects in the state. The Office of Innovative Delivery needs to carefully protect the integrity of the delivery process through effective management of owner’s consulting firms’ conflicts of interest (COIs). However, the state position should not limit the competition in the market. Also, applying limitations to consulting firms at the entire program level should be considered carefully because owner’s consulting firms and their subs are often the most qualified firms to provide exemplary services in other design–build projects. These firms know what the state DOT considers as an exceptional service in each discipline. Thus, flexibility in managing COIs should be considered as an option for the state DOT.

1.10.6 Concerns of the State Engineering Consultant Industry

Sometimes, the local engineering consulting community has the perception that design–build program limits opportunities for their participation in the state DOT’s works. The state DOT engages with a large national or international consulting firm through an extensive contract to provide the agency with program management and general engineering services. Due to the size of these contracts and required massive skillsets, local small- to mid-size engineering consulting firms cannot take a lead to participate. Although local small firms find opportunities to be a part of the owner’s prime consulting firm they often prefer working directly under the state DOT. Sometimes, these local firms may not receive a good portion of the contract as the prime consulting firm is in charge of

distributing the work. The state DOT needs to develop appropriate strategies and provide the right incentives to better engage local firms in the owner's consulting services. For instance, in certain areas of works, the state DOT can ask the prime consulting firm to bring local experts on board through offering additional points in the evaluation of consultant proposals. Also, the state DOT can execute specific task orders, knowing that a good portion of the budget is allocated to local consulting firms. The state DOT needs to do its best to distribute works across different disciplines and among active local consulting firms.

1.10.7 Development of a Proper Performance Measurement System to Keep Track of the Performance of the Owner's Consultant

As the size and complexity of the owner's required services from consulting firms keep increasing, it is reasonable that the state DOT thinks of appropriate metrics to measure the performance of consulting firms. Currently, state DOTs mainly rely on the consultant's self-incentive to deliver a high-quality project in hopes of return business with the Office of Innovative Delivery. Thus, there is a lack of a unified framework to measure the performance of owner's consulting firms throughout different phases of the project development. Such performance measures can facilitate the evaluation of consulting firms and can help the state DOT select the most qualified consulting firm for specific program requirements. Developing a systematic and unbiased set of performance measures represents a great challenge to the Office of Innovative Delivery to track the progress of the owner's consulting team in various areas of concern.

1.10.8 Issues Germane to Disadvantaged Business Enterprises

DBEs in the state are used to work directly under the state DOT that is best familiar with appropriate strategies to engage these firms in a wide range of services. Under the master agreement with the owner's prime consulting firm, the state DOT needs to rely on the consulting team to act similarly on behalf of the state DOT to effectively engage DBEs in providing services for design-build and P3 programs. This transition may be problematic as the owner's consulting firm may not know various DBE participants in the market. Also, the owner's consulting firm is a private firm that needs to run its business as efficiently as possible, in order to provide adequate profits for its shareholders. Hence, the prime consultant may be selective in choosing DBEs to partner with in providing services to the state DOT in design-build program. Naturally, some DBEs may be left out and this may create some tensions in the market. The state DOT needs to manage the interface between DBEs and prime consulting firms, in order to provide several opportunities for these firms to participate in the design-build program. Several state DOTs set goals for DBE participation, and some go farther and request broader DBE participation across several disciplines to avoid concentration.

IDENTIFIED STRATEGIES TO ENHANCE PROFESSIONAL STAFFING OF DESIGN-BUILD DELIVERY PROGRAMS

There are differences among state DOTs on how to respond to the challenges of professional staffing for innovative delivery programs. The next major objective of this study is to identify the various approaches that state DOTs have utilized to respond to their staffing and organizational needs. Organizational structure of a state DOT, regulating legislation and policies, history and culture of the organization, and the design–build industry in the state are among the most important factors that affect the approach the state DOT utilizes to professionally staff its innovative delivery program.

The results of email surveys, structured interviews, and content analysis of several documents identified various models utilized by different state DOTs in managing the workload for DB Programs.

Depending on the overall approach that a state DOT has in delivering DB projects (i.e., centralized vs. decentralized), the role and responsibilities of the HQ and district offices are changed. At the HQ level, state DOTs have utilized different organizational models to professionally staff the Office of Innovative Delivery. Most state DOTs that have an active design–build program have established a dedicated office to manage design–build-related activities centrally at the HQ office. Temporary organizations are normally used when a project is substantially large and complex in terms of budget and the extent of design and construction. Thus, a separate office is dedicated to the megaproject (or program) to manage the contract and oversee the project(s) with more control. Some state

DOTs without a substantially large design–build program do not have an established office for innovative delivery and, depending on the project, might use a temporary office organization to manage the project. Some other DOTs that have a dedicated office for innovative contracting may also prefer to establish a specific temporary office dedicated to the related project management activities of the megaproject. For instance, the Maryland State Highway Authority (MDSHA) established a dedicated office to manage the Intercounty Connector (ICC) megaproject.

The researchers have identified differences in organizational structuring and professional staffing for innovative project delivery programs by studying the practices in the following areas.

1.11 Models of Office of Innovative Delivery: Organizational Structuring and Professional Staffing

State DOTs use different numbers of employees at their HQ offices of innovative delivery based on their available resources and program size. The combination of the staff also depends on the size of the program, number of DB projects that the state DOT is delivering, and any limitations on hiring in-house staff. **Figure 3** shows different models that are currently used in state DOTs to manage DB workload. On one end of the spectrum, some DB programs, such as Colorado DOT, only have one person in charge of administrating the Office of Innovative Delivery with no dedicated person to the office. Some others, like the Minnesota, Maryland SHA, and New York State DOTs, provide an assistant office head to assist in the administration of DB programs. Some state DOTs have dedicated PMs to the DB program, but other DOTs assign PMs from the regular

construction program to the DB program, as needed. On the other end of the spectrum, some state DOTs, such as North Carolina DOT, enjoy more dedicated resources, e.g., multiple dedicated PMs, design engineers, construction PMs, and environmental specialists.

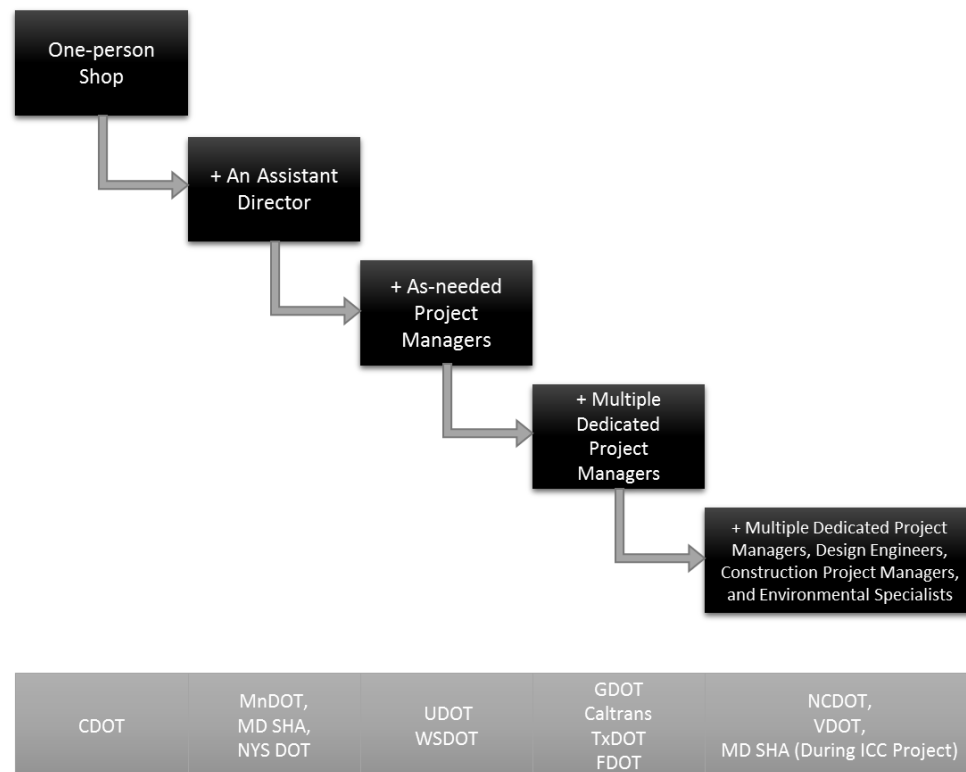


Figure 3 - An Overview of Design-Build Programs in Different State DOTs

State DOTs that are decentralized in delivery of DB projects have more resources at the district offices to handle project management, engineering design, and construction management issues. The size of the Office of Innovative Delivery in these state DOTs is typically small. Delivery of DB programs is centralized in some state DOTs where procurement and project management activities are primarily conducted at the HQ Office of Innovative Delivery. These state DOTs dedicated more full-time staff to their Office of

Innovative Delivery to keep up with the DB demand. Some state DOTs where the number of design-build projects often fluctuates from one year to the next need to staff their innovative delivery programs with PMs from the regular DBB program, as needed. This is an efficient approach to cope with changes in the inflow of the projects. **Figure 4** shows the number of full-time employees in the Office of Innovative Delivery or in the DB program at HQ, which is extracted from a survey performed by the Design-Build Institute of America (DBIA) in 2016.

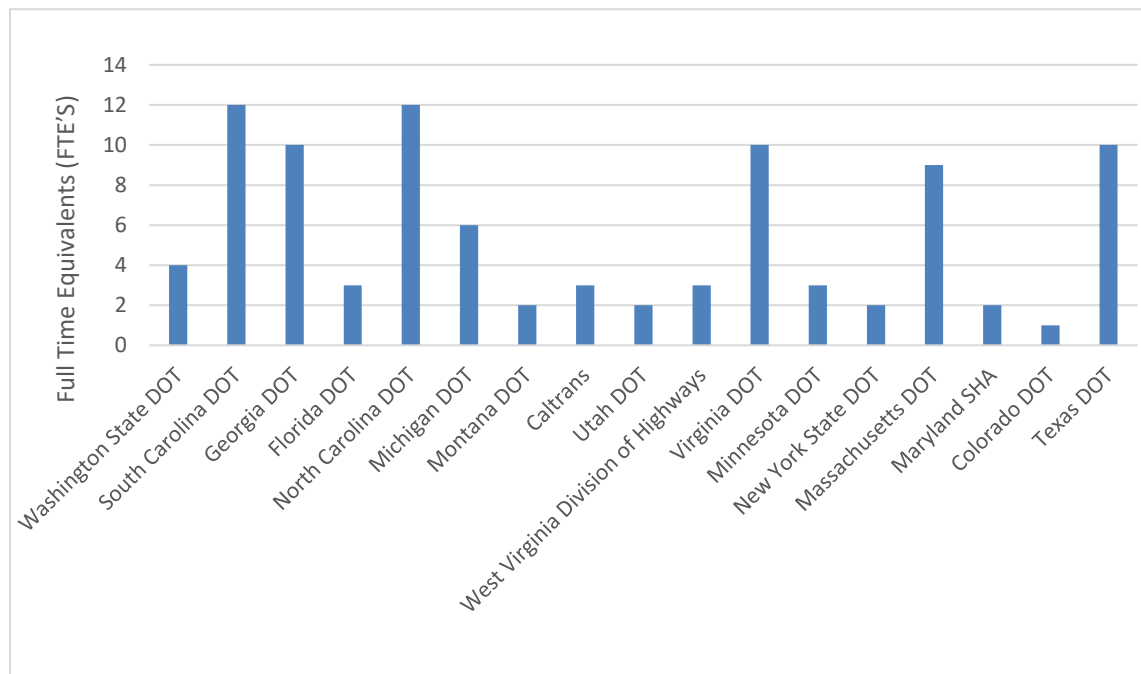


Figure 4 - Number of Full Time Equivalents (FTEs) Dedicated to Office of Innovative Delivery in Different State DOTs

The model of HQ office and also assigned roles and responsibilities on each party affect the number of full-time employees in state DOTs' Office of Innovative Delivery and any related offices. There are several state DOTs with DB programs that have no dedicated

office for delivering DB projects. As needed, the following state DOTs assign their design–bid–build project managers (PMs) to be in charge of their design–build projects:

- Oregon DOT
- District of Columbia DOT
- Maine DOT
- Nevada DOT
- Vermont Agency of Transportation
- Kansas DOT
- Ohio DOT
- Missouri DOT
- Louisiana Department of Transportation and Development
- New Mexico DOT

Regardless of the model used to staff the DB office at the HQ, state DOTs must satisfy the Federal Highway Administration’s (FHWA’s) requirement related to responsible charge which explains state transportation agency (STA) is responsible for construction of federal-aid projects, whether it or a local public agency (LPA) performs the work. The regulation provides that the STA and LPA must provide a full-time employee to be in “responsible charge” of the project.

1.12 Main Roles and Responsibilities of the HQ Office of Innovative Delivery

State DOTs are different in terms of the role of their Office of Innovative Delivery at the HQ. The HQ Office of Innovative Delivery can accept one or several roles from the following:

- Support, advisory, training, and policymaking role
- Administration role for project development, design development, procurement, and contracting
- Contract administration and construction project management role during the post-award phase of the project

Table 1 shows different roles that the HQ Office of Innovative Delivery plays in delivering design–build projects in different state DOTs. HQ offices of innovative delivery in some state DOTs, such as Florida and Colorado DOTs, have a primary advisory/support role. These HQ offices rely on available expertise and resources in the DOT district offices to develop and deliver their own DB projects. This decentralized approach can only be successful in state DOTs that are immensely familiar with DB project delivery system. In these offices, the district offices are capable of taking a lead on the development of DB projects in their own districts. Particularly, those district offices are comfortable with the nuance of procurement and contracting for DB projects.

Some other HQ offices of innovative delivery, such as that in Virginia DOT, are also solely in charge of procurement. These state DOTs believe there is great value in centralized procurement as this phase of project delivery is a critical phase in the project development. This approach facilitates the consistent implementation of procurement practices for design–build projects across the state. District offices come on board in these states after the design–build project is awarded.

Other HQ offices of innovative delivery, such as those in Georgia and North Carolina DOTs, accept the entire responsibility for developing, delivering, and managing

design–build projects from inception to completion. These HQ offices provide project management and contract administration resources during the post-award phase of the design–build project. This centralized approach requires substantial resources dedicated at the HQ to manage various aspects of the design–build project development process.

Table 1 - Different Roles that HQ Office of Innovative Delivery Plays in Delivering Design-Build Projects in Different State DOTs

State DOT	Support, Advisory, Training, and Policymaking Role	Administration Role for Project Development, Design Development, Procurement, and Contracting	Contract Administration and Construction Project Management Role during the Post-award Phase of the Project
Maryland SHA	✓	✓	✓
Georgia DOT	✓	✓	✓
North Carolina DOT	✓	✓	✓
Virginia DOT	✓	✓	✓
Minnesota DOT	✓	✓	District Offices take over the project during the post-award
Caltrans	✓	✓	District Offices take over the project during the post-award
Utah DOT	✓	✓	District Offices take over the project during the post-award
Texas DOT	✓	District Offices develop design-build projects and select the design-builder	District Offices take over the project during the post-award
Colorado DOT	✓	District Offices develop design-build projects and select the design-builder	District Offices take over the project during the post-award
Florida DOT	✓	District Offices develop design-build projects and select the design-builder	District Offices take over the project during the post-award
Washington State DOT	✓ Districts are involved as well	District Offices develop design-build projects and select the design-builder	District Offices take over the project during the post-award

Missouri DOT	✓ Districts are involved as well	District Offices develop design-build projects and select the design-builder	District Offices take over the project during the post-award
--------------	-------------------------------------	--	--

1.13 Involvement of District Offices in Delivery of Design–Build Projects

There are variations among state DOTs in terms of how they involve district offices in developing design–build projects. The model they choose has a significant effect on the roles and tasks that are assigned to the HQ and also the relationship with the districts and other offices in DOT. **Figure 5** shows variations of district offices in delivery of design–build projects. The more tasks and responsibilities district offices can handle, the more decentralized the state DOT is in handling procurement, administration, and management of design–build projects.

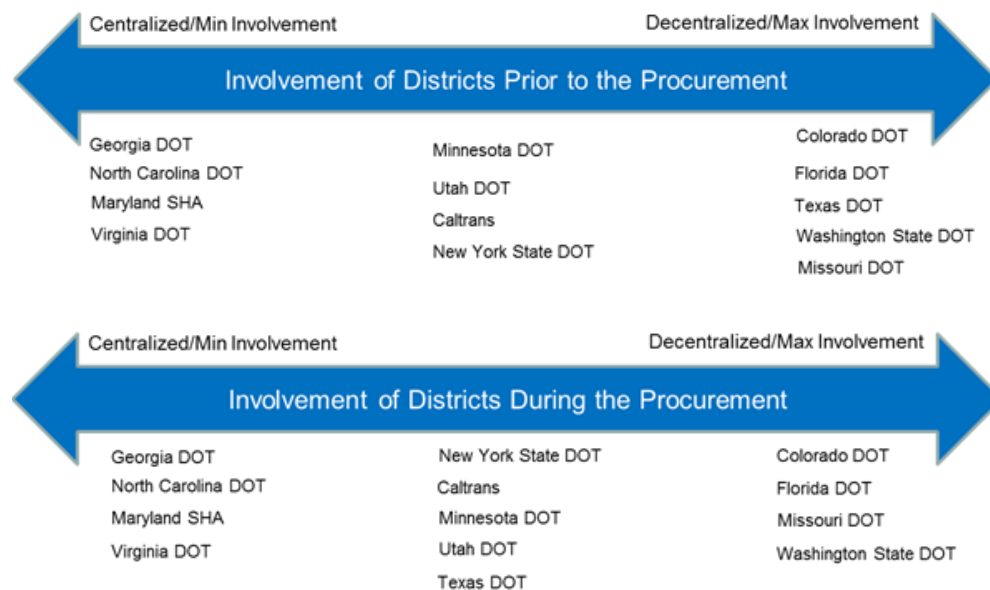


Figure 5 - Variations of District Offices in Delivery of Design–Build Projects

On one end of this spectrum, Florida and Colorado DOTs have a dedicated office in the HQ for innovative project delivery but district offices are responsible for planning, preliminary design, procurement, and construction administration of design–build projects. The main role of the HQ Office of Innovative Delivery in these states is to develop guidelines or boilerplates for the contracts and assist the district offices in contracting.

Some state DOTs fall in the middle range of this spectrum. In these states, district offices are active in design–build programs and take over the responsibility of the design–build project once it is awarded. District offices might be involved during the procurement phase, but the main responsibility falls under the HQ office to execute the procurement, select the design–builder, and award the contract. Examples of such practice are found within the Minnesota DOT, Caltrans, and New York State DOT.

On the other end of the spectrum, some state DOTs, such as Georgia, North Carolina, and Virginia DOTs, perform all the related tasks in a dedicated design–build office at the HQ. District offices play a minor role in the delivery of design–build projects in these states. For instance, Virginia DOT has some minor design–build projects that are being done locally at the district offices. This practice is mainly utilized to dedicate the authority of small design–build projects to the local offices and make them more familiar with the dynamics of the innovative project delivery systems. Maryland State Highway Administration follows a similar practice for executing small design–build projects. The design–build PM is assigned to the project at the HQ Office of Innovative Delivery in Georgia and North Carolina DOTs without much involvement from the district offices. This practice is slightly different from that in Virginia DOT in that the district office assigns

a dedicated PM to the design–build project to become engaged with the project from inception to completion.

DOTs' district offices have a wide range of responsibilities and roles. Some of the large design–build programs have tried to get district offices involved in a variety of tasks for planning, preliminary engineering, procurement, and post-award activities for design–build projects. This is considered as an appropriate strategy to enhance the utilization of alternative delivery in the state. **Table 2** shows how district offices in different state DOTs perform different types of tasks related to the delivery of design–build projects throughout different phases of project development. The more decentralized a design–build program becomes, the more involved the district offices are in the delivery of the design–build projects. The tasks that are assigned to the district offices mainly depend on the size of the program, available resources in the HQ, and available expertise in the district offices. As an example, in the Colorado DOT, there is only one full-time employee available in the HQ, whose main role is support and advisory. Therefore, it is only practical to assign the administration of design–build projects to the district offices. It is worth noting that district offices often bring consulting firms on board to assist them in performing the identified tasks as they may not have the time, resources, or skills to perform them.

Table 2 - Tasks Performed by District Offices to Assist the HQ Office of Innovative Delivery in Different State DOTs

Phase of the Project	Tasks	State DOT						
		Utah DOT	Texas DOT	Caltrans	Colorado DOT	Florida DOT	Washington State DOT	Missouri DOT
Prior to the Procurement	Assist the HQ in establishing design-build rules and policies, and developing tools to support implementing the design-build program	-	<p>✓</p> <p>TxDOT has an executive oversight committee made up of district engineers that help advise the HQ office.</p>	General policies are developed by HQ. District may have an opportunity to review them.	-	-	<p>✓</p> <p>WSDOT has an internal design-build work group which develops policy. It meets regularly and is composed of staff from region offices, HQ, and mega projects.</p>	<p>✓</p> <p>One dedicated design-build coordinator manages this with input from design-build teams in districts.</p>
	Be responsible to assess the appropriateness of design-build for a project and identify candidate projects for design-build	✓	<p>✓</p> <p>TxDOT has a tool that helps determine if a project would be better as design-bid-</p>	<p>✓</p> <p>Districts nominate projects for design-build. The nominations are</p>	✓	✓	<p>✓</p> <p>Collaboration between HQ and Region exists. The probable project</p>	<p>✓</p> <p>A variation of the University of Colorado project delivery selection matrix with an initial</p>

			build or design-build. The districts supply the data for the tool.	reviewed by the HQ office that prepares a recommendation to the management as to whether the project is a good candidate.			delivery method is determined at HQ. The final project delivery method is determined by the region.	risk assessment is used to vet projects.
	Hire consulting firms to assist the district office in procurement and related tasks	✓	✓ The districts hire a general engineering consultant (GEC) to help them with schematics, environmental and technical components.	If help was needed to procure, HQ would hire the consultant. This is not the standard practice.	✓	✓	✓ This task is solely the responsibility of the a region (district) office.	✓ Consulting firms provide more support related activities (e.g., utilities, survey, traffic, and preliminary design)
	Hire and sign the contract with the owner's consulting firm(s)	✓	✓ The division owns the procurement process and hires procurement	This would be a HQ function if used.	✓	✓	✓ This task is primarily the responsibility of a region office.	✓

			engineers and attorneys to help them.					
During the Procurement	Take a lead in performing preliminary engineering to prepare the materials for the RFP	✓	-	✓ All preliminary engineering is done by the districts.	✓	✓	✓ Region office and HQ collaborate on this task.	✓
	Assist the HQ in the procurement process of design-builder (or developer)	✓	✓	✓ Districts are active participants in the procurement process (developing RFP, participating in one-on-one meetings, reviewing ATCs, and evaluating proposals).	✓	✓	✓ This task is primarily the responsibility of a Region office.	✓ The District is the lead, not HQ.
	Take a lead in procurement of design-builder (or developer)	-	✓	HQ is the lead.	✓	✓	✓ This task is mainly the function of a	✓

							region (district).	
Post-Award	Designate a district engineer to oversee and administer the design-build contract, and manage scope, schedule and budget of the design-build project	✓	✓	✓ Districts assign a contract manager to administer the contract.	✓	✓	✓ The region office designates a project engineer to administer the contract with assistance from an assistant state construction engineer from HQ.	✓
	Take over the management of the project upon the award of the contract.	✓	✓	✓ Districts administer the contracts.	✓	✓	✓	✓
	Be responsible for design oversight	✓	✓	✓	✓	✓	✓ This task is mainly the responsibility of a region office.	✓ Central office supports this function.

	Be responsible for construction oversight (e.g., visiting construction job sites on a regular basis, responding to any issues from the contractor during the construction, etc.)	✓	✓	✓ HQ provides support and is involved in change orders and dispute resolution.	✓	✓	✓ This task is mainly the responsibility of a region office.	✓
Operations and Maintenance	Manage the operations and maintenance of design-build and P3 projects	✓	✓	✓	✓	✓	Region office and HQ collaborate on this task.	✓

Table 2 continued- Tasks Performed by District Offices to Assist the HQ Office of Innovative Delivery in Different State DOTs

Phase of the Project	Tasks	State DOT					
		New York State DOT (NYSDOT)	Maryland SHA (MDSHA)	Georgia DOT	North Carolina DOT	Virginia DOT	Minnesota DOT
Prior to the Procurement	Assist the HQ in establishing design-build rules and policies, and developing tools to support implementing the design-build program	A continuous improvement and feedback process is in place to shape policy. Ultimate decision for change in process and procedure resides with the project and design build management office (P&DBO).	-	-	-	-	- Districts being asked for advice/review when necessary.
	Be responsible to assess the appropriateness of design-build for a project and identify candidate projects for design-build	Regional offices make design-build project recommendations to the P&DBO for review and approval.	District office may be part of team to assess but recommendation of appropriateness is from the	-	-	✓	✓

		A straightforward informational process is used to decide what should be delivered via design-build.	innovative contracting.				
	Hire consulting firms to assist the district office in procurement and related tasks	NYS DOT has a procurement support consultant and a design quality assurance support consultant on each project.	Procurement is managed by HQ.	--	-	-	-
	Hire and sign the contract with the owner's consulting firm(s)	The P&DBO is responsible for contracts with consultants that support the design-build delivery.	Consultant firms, design or construction, are procured through the office of procurement and contract management. Generally, the construction management/construction inspection	-	-	-	-

			<p>(CM/CI) contracts are developed by the central office of construction for all districts.</p> <p>Design contracts are developed by the lead design office.</p>				
During the Procurement	Take a lead in performing preliminary engineering to prepare the materials for the RFP	<p>✓</p> <p>Preliminary engineering remains the duty of the regional design offices.</p> <p>The P&DBO provides guidance related to content of the design approval document (DAD) to ensure the right level of engineering is performed to</p>	Design is lead from HQ.	-	-	-	<p>✓</p> <p>HQ Office helps as much as needed, but not much.</p>

		support a quality RFP.					
	Assist the HQ in the procurement process of design-builder (or developer)	✓ District offices provide project content as necessary.	✓ District personnel may be involved in the review of statements of qualifications or technical proposals.	-	✓	✓	✓
	Take a lead in procurement of design-builder (or developer)	P&DBO is the lead for consistency of the program.	Procurement is led by HQ.	-	-		- MnDOT believes that it's wise to run the program centrally but be friendly such that the district appreciates the help and participates appropriately.
Post-Award	Designate a district engineer to oversee and	A regional PM is assigned, but	✓	✓	✓	✓	✓

	administer the design-build contract, and manage scope, schedule and budget of the design-build project	reports to the director of the P&DBO for policy, procedures, and administrative guidance	The district office administers and manages the contract.				Districts needs central guidance as well.
	Take over the management of the project upon the award of the contract.	Regional PM is responsible for day to day job. Overall project and program responsibility resides with the P&DBO Director.	✓ Contractually, it is the district's responsibility to manage.	-	-	✓	✓
	Be responsible for design oversight	A DQAE works for the PM to provide design oversight. The design quality assurance engineer (DQAE) consultants are procured by the P&DBO.	All design acceptances are from the lead design office.	-	✓	✓	✓ Assisted heavily by a separately-hired design oversight consultant and/or central functional staff (MnDOT has dedicated DB bridge and semi-

							dedicated DB geotech personnel) Soon to be assisted by a central assistant PM.
	Be responsible for construction oversight (e.g., visiting construction job sites on a regular basis, responding to any issues from the contractor during the construction, etc.)	Regional PM performs daily tasks. All risks and issues are routinely reported to the P&DBO. Contract disputes and claims are resolved at the P&DBO. Quality issues are resolved at the P&DBO too.	✓ The district is responsible for construction management and inspection.	-	✓	✓	✓
Operations and Maintenance	Manage the operations and maintenance of design-build and P3 projects	✓	✓ Operations and maintenance is provided by the district office.	✓	✓	✓	✓

1.14 Training and Staffing Strategies and Preferred Skillsets

Developing skilled workforces for the Office of Innovative Delivery is a daunting challenge for all the state DOTs. Attracting and maintaining the subject matter experts in DB and alternative delivery is even more difficult currently, considering the DOT's limitations in recruiting new hires and compensating the staff at a comparable level with the private-sector consulting firms. At the same time, innovative project delivery needs to get acceptance from other disciplines in the Department. As a new model for project development, DOT professionals in different offices need to be further educated and bought into the new paradigm, as their support is key to sustaining efforts to enhance the breadth and quality of DB programs.

The research team addressed these challenges and surveyed heads of offices of innovative delivery in different state DOTs about their strategies in two main areas of staffing:

1. What strategies have they used to inform and educate internal DOT staff about design–build and P3 programs?
2. How has their agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in design–build or P3 projects?

Table 3 - A Summary of Different Strategies Utilized by State DOTs in Enhancing the Awareness of the Internal Staff about Design-Build and Developing Skilled Workforces to Staff Design-Build Program

State DOT	What strategies have been used to inform and educate internal DOT staff about DB and P3 program?	How has the agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in DB or P3 projects?
Minnesota DOT (MnDOT)	<p>MnDOT does not have a sustained effort yet, but</p> <ul style="list-style-type: none"> • DB program manager is developing half-day classes for program and project managers this year. • DB program manager provides short training sessions as needed for project delivery method selection meeting and as needed for staff working on projects. • He also occasionally trains districts as needed/requested. 	<ul style="list-style-type: none"> • Small districts do not have enough DB projects to maintain knowledgeable staff in most cases. • Two of the three larger districts have developed an ‘alternative delivery’ expert who is the first-choice PM for any alternative delivery project in those areas. • Main problem: <ul style="list-style-type: none"> ○ If one of the people who are working as PM is promoted or leaves, his/her experience is irreplaceable in short-term. • Good news: MnDOT is currently hiring an assistant to DB program manager position. • Right now, DB program manager works closely with PMs during procurement as an assistant PM. He trains them in DB methods by helping them through all DB-specific activities. Following procurement, however, he does not have a specific role. • New assistant to DB program manager will essentially do the same thing he is doing now (assist/train) following letting. • Benefits of hiring assistant DB program manager: <ul style="list-style-type: none"> ○ It is believed that this will increase DOT’s oversight consistency, better train construction PMs, and save money that otherwise would have been spent on consultants. ○ It is believed that the assistant will also be ‘bench strength’ for the DB program in case the current DB program manager leaves someday.
Further Information (MnDOT)	MnDOT management instructed DB program manager not to use P3 in the DB program.	

State DOT	What strategies have been used to inform and educate internal DOT staff about DB and P3 program?	How has the agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in DB or P3 projects?
Texas DOT (TxDOT)	<ul style="list-style-type: none"> • TxDOT is currently finalizing final design–build phase and operations and maintenance (OM) phase Project Manager Guides. • TxDOT has engaged the design–build industry and department subject matter experts to develop standardized documents including a Design–Build Procurement Manual, Design–Build Agreement, and Design–Build Specification Book. Final first drafts of each are nearly complete. • TxDOT conducted district tours to discuss roles and responsibilities and program goals. • TxDOT added processes and procedures. • TxDOT is currently drafting a plan that will review current trainings and identify the goal of new/revised trainings, attendees, and frequency of training. Plan also includes a process for soliciting training feedback for improvements to existing courses, guidelines, and identifying gaps. • TxDOT is currently developing a Contract Administration Manual and financial manuals for P3 projects. • Current training classes include: DB 101 (2 days) Executive DB101 (4 hours), Design Oversight, Quality Assurance program, one-day project-specific start-up training. 	<p>TxDOT did not have any specific plan to do so, but it is implementing a succession planning program this year, and believes that might help it address the issue.</p>
New York State DOT (NYSDOT)	<ul style="list-style-type: none"> • For the NYSDOT DB program, when DOT created its Design–Build Procedures Manual (DBPM) these components were included and made available online: <ul style="list-style-type: none"> ○ Educational piece ○ Basic training ○ Presentations 	<ul style="list-style-type: none"> • There have not been formal efforts up until now. • Originally, a person was designated as the DB program lead reporting directly to the commissioner. • The delivery of the projects was highly dependent upon consultant services working with district staff.

State DOT	What strategies have been used to inform and educate internal DOT staff about DB and P3 program?	How has the agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in DB or P3 projects?
	<ul style="list-style-type: none"> • NYSDOT conducted formal classes as well. • This material has been updated and as each design–build project is identified, the staff involved get trained on relevant design–build processes. • In addition, NYSDOT is currently updating its DBPM—this effort includes updating the training (with a particular focus on post-award activities). 	<ul style="list-style-type: none"> • Currently, primarily because the DB lead person left NYSDOT, the DB program has been assigned to a newly created Project Management Office (PMO)—still very dependent on consultant support. • Outside the PMO, NYSDOT does not have designated design–build staff. • Project manager at the region level is assigned on a project-by-project basis, typically, a one-time assignment for that region.
Further Information (NYSDOT)	<ul style="list-style-type: none"> • NYSDOT does not have any P3 experience or process, nor does it have legislative approval to use the P3 project delivery method. 	
Maryland State Highway Authority (MDSHA)	<ul style="list-style-type: none"> • As part of D-B training for new employees, MDSHA has 3 training modules: <ul style="list-style-type: none"> ○ D-B Design ○ D-B Procurement ○ D-B Project Management and all employees are invited to attend the training. 	<ul style="list-style-type: none"> • MDSHA district offices take many things into consideration when assigning construction staff to a D-B contract. • MDSHA believes that scope of work, not necessarily the project delivery method, will determine who is best qualified to take leadership positions.

State DOT	What strategies have been used to inform and educate internal DOT staff about DB and P3 program?	How has the agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in DB or P3 projects?
Further Information (MDSHA)	<p>Lessons learned from the Intercounty Connector (ICC):</p> <ul style="list-style-type: none"> • Office of Highway Development was the lead that <ul style="list-style-type: none"> ○ Provided program oversight from design initiation through construction ○ Was directly responsible for overseeing procurement/selection process • Program Management was led by the Office of Highway Development, and Contract Administration was led by District Construction. Related challenges were: <ul style="list-style-type: none"> ○ Required strong project management skills ○ Needed ability and willingness to partner between design & construction ○ Was dependent on all MDSHA staff to meet critical dates • <i>Innovative Strategy</i>: Senior members of the following MDSHA offices were teamed up with the respective developer's team to facilitate smooth decision-making about the project: <ul style="list-style-type: none"> ○ Office of Highway Design, Office of Environmental Analysis, and Office of Construction/Procurement • This decision was not perceived problematic for these offices although they were losing great subject matter experts. In fact, MDSHA tried to make the best of this situation. These experts were getting close to the end of their careers and were looking for exciting and challenging opportunities toward the end of their careers in the agency. Working on such high-profile projects actually helped them to find further consulting opportunities after their retirements from the agency. Also, inside the offices after these senior people left, room was created for the next generation of experts to move up the organizational ladder. It provided career advancement opportunities for other people in these offices. 	

State DOT	What strategies have been used to inform and educate internal DOT staff about DB and P3 program?	How has the agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in DB or P3 projects?
Colorado DOT (CDOT)	<ul style="list-style-type: none"> • CDOT has an internal formal DB training program. • CDOT has been using DB for more than 20 years so there are numerous very knowledgeable project managers within each region that informally educate other staff about DB and P3 either by word or when assigned to a particular project. • CDOT has the D-B Manual and the P3 Manual available on the CDOT website that have a wealth of information about various phases of the D-B project delivery method. 	<ul style="list-style-type: none"> • CDOT does not have a formalized process for this. • CDOT is very decentralized. The regions procure and deliver their projects and HQ acts only as a support. <ul style="list-style-type: none"> ○ DB program manager is the only staff member in the Innovative Contracting Office. ○ The regions try to assign staff that have adequate experience in D-B in order to deliver successful D-B projects.
California Department of Transportation (Caltrans)	<ul style="list-style-type: none"> • One of the main strategies Caltrans has used to educate and inform about DB and P3 are presentations to staff in a variety of forums: <ul style="list-style-type: none"> ○ Caltrans provides a short 30–60-minute presentation at staff meetings throughout the state to let staff know about the programs, why DOT uses these tools (benefits of DB and P3), what the status of programs and projects are, and what we have learned to date (best practices). ○ Caltrans also provides written articles about the programs in various Caltrans publications. • When a DB or P3 project is initiated, Caltrans provides more intensive training: <ul style="list-style-type: none"> ○ Each team member on a DB project attends at least one of two training classes that Caltrans has purchased through the American Society of Civil Engineers (ASCE) 	<ul style="list-style-type: none"> • For the first round of projects, Caltrans did not have this type of pool of candidates because these processes were new to Caltrans. • Now that Caltrans have done some projects, they have identified those staff who seemed to understand the methodologies and are now assigning that staff to future projects. • In addition, Caltrans is focusing on identifying key personnel for future projects to make sure that they have the skills and attitudes necessary for these methods. • Caltrans is considering requesting resumes and possibly interviewing for staff for future projects.

State DOT	What strategies have been used to inform and educate internal DOT staff about DB and P3 program?	How has the agency tried to develop a pool of qualified candidates inside different offices that can take leadership positions in DB or P3 projects?
	<ul style="list-style-type: none"> ○ The first class is focused on the procurement process and how to develop an RFP. ○ The other is a class on how to administer a DB project. <ul style="list-style-type: none"> ➤ Each class is two days. • Caltrans has also provided a couple of DBIA classes to its staff. • For its one P3 project, Caltrans' P3 program developed training modules and delivered those using Caltrans' own staff and consultants. 	
Washington State DOT (WSDOT)	<ul style="list-style-type: none"> • WSDOT is in the process of developing an extensive internal training program on all aspects of DB. <ul style="list-style-type: none"> ○ It should be complete by 06.30.17. • The program material will be utilized to train WSDOT staff through instructor-led programs, as well as web-based instruction. 	<ul style="list-style-type: none"> • WSDOT currently utilizes knowledge transfer between project staff, as well as between staff in different regional offices with DB experience to develop candidates for leadership on DB projects.
Missouri State DOT (MoDOT)	<ul style="list-style-type: none"> • Currently the only strategy that MoDOT uses in place has been to create a "Project Manager – Design Build Coordinator" position to guide Project Leadership through the process. • MoDOT is currently exploring more robust training. 	<ul style="list-style-type: none"> • The current strategy has been to keep previous project staff involved in new projects. <ul style="list-style-type: none"> ○ MoDOT has seen previous leaders take over new projects, and previous field engineers move into project leadership positions. • MoDOT is relatively new to design–build (Procuring 11 and 12 DB Projects now). <ul style="list-style-type: none"> ○ MoDOT is working through these issues as it uses design–build more and more. • MoDOT believed that these are definitely challenges MoDOT is currently faced with and are working on solutions.

1.15 Utilizing Consulting Firms to Assist the Owner

Utilizing consultant companies is a common practice in most state DOTs in managing design–build programs. State DOTs try to leverage their in-house staff by outsourcing some of the roles and responsibilities to outside consultants. Some state DOTs utilize consulting firms in an early stage of a program or a project during policy-making and developing guidelines. Some other DOTs might do these tasks internally and use consultants during the procurement process. Any of these practices largely depend on the DOT’s budget, and program size and complexity. If the state DOT has the capability of performing any of the major roles that were mentioned in the previous section in-house, it will not use consultants as much as other DOTs that do not have any in-house skilled workforce capable of doing those tasks. There are several areas that are worth studying regarding outsourcing and design–build programs. The researchers interviewed several subject matter experts in state DOTs and consulting firms, and identified the following areas that make outsourcing practice unique for each transportation agency.

1.15.1 Prequalification, Licensing Requirements, and Selection Criteria for Evaluating Consulting Firms (Licenses, Requirements)

Consulting firms can work with a state DOT in a variety of roles and responsibilities to assist the DOT in executing tasks in different disciplines. In general, the consulting firm needs to be prequalified in the anticipated discipline that it is going to provide services; for example, the consultant needs to be registered and certified for professional engineering services in the state if engineering design tasks are required in the DOT services. State DOTs select the consultant firm purely based on their qualification. Several external factors

are also considered as important selection criteria for evaluating the consulting firm, such as whether the consulting firm was onboard for other projects with the DOT, whether the consultant company is a local company that can help grow the design–build capability among the state consulting industry, and whether the consulting firm brings national and international expertise to the state’s design–build industry. One of the most important factors for a state DOT to select a consultant firm is the team composition of the firm and the firm’s available expertise. Consulting firms always strive to satisfy the required tasks with experienced, qualified, and competent staff that are knowledgeable in different aspects of innovative project delivery. Also, state DOTs are always interested in innovative solutions developed by the consulting firm to provide significant savings in project cost and schedule. Thus, understanding the project goals and offering innovative solutions to address the project challenges are among the most critical criteria for the evaluation of consulting firms. Overall, the selected consulting firm should assure the state DOT that it can act as a true extension of the state DOT organization and fulfill the DOT’s mission to protect the best interests of the state in the design–build program.

For example, some state DOTs like NCDOT have a list of selection criteria for evaluation of consulting firms like

- Experience, qualifications, and technical competence of the staff proposed
- Breadth of expertise of the firm(s), including national involvement in alternative delivery projects
- Past performance of the firm(s)
 - Track record of the firm’s ability to provide satisfactory client support under a multi-year contract

- Responsiveness to NCDOT, and the availability/readiness of the proposed staff
- Familiarity of the firms with NCDOT practices and procedures, including design–build projects
- Team composition and extent of prequalification across various disciplines

Some of the DOTs besides having a list of criteria for selection process have specific prequalification of licensing requirements like VDOT and TxDOT. For instance, the text below is extracted from TxDOT’s template contract:

“Certification requirement and annual renewal requirement count as deal-breaker issues and absolute requirements that, without them, the firm would be ineligible to compete to assist Texas DOT in design–build project delivery. Note that for non-listed work categories precertification is not required. Also, the proposed team must demonstrate that a professional engineer, registered or licensed in Texas, will sign and seal the work to be performed on the contract. For purposes of executing an engineering contract and doing work with TxDOT, the prime provider must be registered with the Texas Board of Professional Engineers.”

1.15.2 Selection Process

According to the Brooks Act (U.S.C. 40 Chapter 11), consulting firms should only be selected based on their qualifications. State DOTs use qualifications-based selection (QBS) as the procurement method. Consulting firms are not allowed to put any factors regarding price in their proposals. Often, oral interviews are conducted to further evaluate the proposed consulting firm. State DOTs typically use their own staff in the selection committee to evaluate consulting proposals. Utah DOT uses an advisory consultant to assist

the DOT in the selection process for owner's consultants that help district offices in the development of design-build projects.

1.15.3 Contracting and Payment Methods

Consulting firms are typically brought on board through an indefinite delivery/indefinite quantity (IDIQ) master contract. Owner's consultants' contracts are on-call contracts, as state DOTs want to maintain flexibility in assigning different tasks to consulting firms. A tentative list of tasks is defined in the master agreement, but the amount and timing of these tasks vary over the course of the contract. The maximum amount of total contract is defined in the master agreement. The duration of the master contract is typically 3 to 5 years. At any point of the contract, the state DOT executes the needed task(s) as a special task order. The scope of the services, the required milestones, and the payment mechanism must be clearly defined in the task order.

In the master agreement, some state DOTs try to provide an estimate of percentage for each task that the consultant's services may be utilized on. This approach helps the consulting firm prepare better for the anticipated tasks and allocate resources (especially skilled workforces) more efficiently to the owner's services.

Basis of reimbursement varies from contract to contract. State DOTs typically use lump-sum and cost plus fixed-fee as the payment method for the task order agreement. The decision of the payment method depends on the type of the task assigned to the consultant. The decision also depends on the phase of the project, which determines the source of funding for the project. Lump-sum contracts are often utilized by state DOTs during the

construction phase of the design–build project as the funding during the construction phase is usually spent on a lump-sum basis.

For example, NCDOT, VDOT, MnDOT, TxDOT, and CalTrans all have on-call/as-needed contracts with their consulting firm. They usually put the consultant firm on more than a project based on the scope of the projects.

1.15.4 Assigned Tasks to the Owner’s Consulting Firm

State DOTs assign a wide range of tasks to the selected owner’s consulting firms. These tasks represent all the required activities that must be performed to deliver design–build projects. The researchers divided these tasks into several categories based on the timing of the tasks throughout the project timeline. A comprehensive list of activities is provided below that the state DOT can use as a template or a **checklist** to determine the required needs of the project.

1.15.4.1 Tasks Performed during the Planning Phase of the Project to Develop the Project Scope and the Initial Baseline for the Project Cost and Schedule

1. Conduct initial meetings with the state DOT design–build (or P3) staff to review and discuss the design–build (or P3) process, and roles and responsibilities
2. Conduct research to identify best practices in various areas of design–build (or P3) contracting and assist the state DOT in refining its design–build (or P3) manual
3. If the state DOT is new to design–build, identify any necessary changes in existing standard contract specifications and practices to accommodate design–build and assist the state DOT in providing engineering expertise in developing new contract provisions to implement design–build

4. Assist the state DOT in the critical assessment of the appropriateness of a design–build (or P3) delivery system for a project, and recommend a list of candidate projects for design–build (or P3) program
5. Organize a goals workshop to identify project goals
6. Develop documents in support of project funding, especially through utilization of alternative funding sources and innovative financing mechanisms (e.g., collection of data and the preparation of a GEC report to support the issuance of toll revenue bonds)
7. Establish and maintain a project office to support staff for the project (e.g., management of vendor services, development of procedures, communications and document control, and logistical support for multiple project offices)
8. Perform environmental studies, document preparation, and review
9. Perform field surveying and photogrammetry
10. Develop plans for public involvement, public relations, and stakeholder engagement services
11. Develop 3D visualizations and animation of transportation facilities for use in public presentations
12. Develop an initial baseline estimate for the project cost and schedule
13. Facilitate workshops for risk identification, analysis, and mitigation (e.g., identify potential scope, budget, and schedule risks and assess their impacts on the project goals, and prepare mitigation and/or minimization strategies)
14. Prepare the request for letters of interest (RLOI) for the design–build (or P3) project

15. Organize an industry forum to promote the design–build (or P3) project to interested parties

1.15.4.2 Tasks Performed Prior to Release of the RFQ

1. Update the project cost and schedule
2. Update the project risk register
3. Develop qualifications criteria to be included in the request for qualifications (RFQ)
4. Develop the key personnel requirements for design–build (or P3) proposers to be included in the RFQ
5. Prepare the draft and final design–build (or P3) RFQ
6. Assist in the identification of the selection committee, technical evaluation committees, and technical advisors
7. Prepare the evaluation criteria and train the selection committee for the evaluation of the statements of qualifications (SOQs)

1.15.4.3 Tasks Performed During the RFQ Phase

1. Accept, process, and distribute contractor SOQs to the evaluation team members
2. Assist the state DOT in reviewing the submitted SOQs (e.g., process and consolidate evaluation team members' scores)
3. Assist the state DOT in determining the short list of the most-qualified respondents
4. Assist the state DOT with debriefing proposers
5. Update the project risk register and coordinate with the shortlisted teams to prepare mitigation strategies for each identified risk

1.15.4.4 Tasks Performed Prior to Release of the RFP

1. Update project cost and schedule
2. Develop, prepare, and review plans, specifications, and estimates (PS&E)
3. Update the risk register and incorporate the risk mitigation strategies into the RFP as appropriate (i.e., determine assignments for the allocation of risks between the state DOT and the design–build contractor)
4. Assist the state DOT PM in completing the project advertisement checklist
5. Assist the state DOT in developing proposal evaluation criteria, assigning appropriate weights to the criteria, and providing guides on how to rate the proposals
6. Facilitate a training session for the selection committee on the proposal evaluation process
7. Perform advanced planning services including route studies, schematic design and development, and traffic modeling
8. Perform hydraulic and drainage studies and review
9. Perform geotechnical services
10. Perform subsurface utility engineering (SUE)
11. Prepare the preliminary design plans to be included in the RFP
12. Prepare the concept structure situation & layout (S&L) plan to be included in the RFP
13. Conduct toll system and intelligent transportation system (ITS) planning and design

14. Coordinate with utility companies and other affected third-parties, prepare master utility agreements (MUAs) for all affected utilities, and assist the state DOT in obtaining signatures
15. Perform right-of-way (ROW) surveying and mapping, and identify the proposed ROW limits and construction limits for the design–build (or P3) project
16. Assist the state DOT in developing ROW design plans and construction limits plans
17. Assist the state DOT in performing ROW acquisition services
18. Perform design and constructability review of contract plans and specifications for highway construction
19. Prepare the draft and final request for proposals (RFP) specific to the design–build (or P3) project

1.15.4.5 Tasks Performed During the RFP Phase:

1. Assist the state DOT in issuing the procurement documents
2. Organize pre-proposal meetings with all proposers
3. Review request for clarifications (RFCs) from proposers, develop responses, and prepare addenda as necessary
4. Schedule proposers' one-on-one Alternative Technical Concepts (ATCs) confidential meetings
5. Assist the state DOT in the evaluation of ATCs and coordinate with respective state DOT staff to respond to ATCs
6. Prepare the proposal evaluation criteria and tools (i.e., design–build [or P3] evaluation manual, evaluation forms, and score sheets) and provide training to the

members of technical review committees for roadway, management of traffic (MOT), geotechnical, structures, drainage, and public involvement

7. Accept, review, process, and distribute contractor proposals to evaluation committee members
8. Schedule and facilitate the meetings for technical review committees and assist the committees in preparing briefs to the selection committee
9. Perform a follow-up risk workshop with the evaluation committees to evaluate how each proposal addresses risks and compare the risk analysis results from each proposal to the baseline risk to help determine the proposal that provides the most value to the Department
10. Review proposers' construction cost and schedule
11. Make recommendations to the state DOT on potential unsafe conditions created by the provisions in the design-build (or P3) document
12. Assist the state DOT in the selection of the winning proposal
13. Collect all proposal components, reviews, and scoring information; maintain and archive one set of each proposal; and destroy the remaining proposals, review notes, and scoring information.
14. Assist the state DOT in the preparation of contract documents for the successful proposer and with debriefings with the unsuccessful proposers
15. Assist the state DOT protest official with any contractor protest
16. Schedule a lessons-learned meeting at the conclusion of the procurement phase, identify the areas for improvement, and assist the state DOT with process revisions, procedure manuals, and updating standards as appropriate

1.15.4.6 Tasks Performed During the Post-Award Phase

1. Design oversight: Provide services necessary to support the state DOT in receiving, documenting, tracking, reviewing, approving, and responding to all submittals by the contractor (e.g., provide discipline-specific reviews of design submittals to provide assurance that they are in compliance with contract requirements; review the contractor-provided traffic control plan for adherence to the state DOT policies to protect the safety of workers and the travelling public; review structure shop drawing submittals for conformance to contract requirements; coordinate the design submittals with the review of utility and third-party submittals; and evaluate, consult, and provide recommendations to field staff to mitigate varying field conditions as they arise)
2. Provide independent verification and validation of highway design in order to monitor and audit the design development process to ensure compliance with the project design performance requirements
3. Review geotechnical exploration plans and geotechnical recommendations, and provide the oversight necessary to demonstrate compliance with contract requirements
4. Construction oversight: Develop and implement project document and controls procedures and conduct all project management and control tasks to ensure the timely and efficient execution and completion of the design–build (or P3) project (e.g., organize regular technical meetings with the project team; organize regular coordination meetings with the state DOT management; prepare weekly project status reports with action items and follow-up assignments; conduct monthly

invoicing and project accounting activities; and develop, maintain, and update the project dashboard to present critical project information to the state DOT PM and other state DOT officials as deemed appropriate)

5. Provide independent verification and validation of highway construction in order to monitor and audit the construction development process to ensure compliance with specific construction requirements of urban freeways, interchanges, and complex bridges
6. Provide QA/QC process verification to ensure that approved project management plans are working as called for
7. Document and track the identified risks throughout the project execution, and organize risk mitigation meetings as necessary
8. Provide construction engineering and inspection (CEI) services, including construction administration, inspections, material testing, and documentation of contractor work activities, and traffic signal and lighting inspections
9. Perform inspection and testing including owner verification, testing, and inspection (OVTI) services
10. Develop and implement process auditing services
11. Provide toll and intelligent transportation systems (ITS) equipment planning, design, and implementation on transportation facilities
12. Coordinate all environmental activities, conduct environmental inspections at the roadway construction project site, and provide field documentation related to auditing of the contractor's environmental compliance performance

13. Develop and implement an ongoing audit program for oversight of the contractor's safety compliance with the project management plan and the contract, provide recommendations for the issuance of safety compliance orders, and monitor monthly safety reports prepared by construction oversight personnel
14. Avoid, analyze, mitigate, and resolve claims from the design–build contractor (or the P3 developer)
15. Perform public involvement management tasks as the Department's third-party public involvement representative

1.15.5 Key Personnel and Respective Required Skillsets and Qualifications for Owner's Consultants

Managing innovative delivery contracting is different from that of the traditional delivery methods. Therefore, when the state DOT uses a staff augmentation model to manage the workload of an alternative delivery program, it anticipates a different set of unique skills for managing design–build and P3 projects. Technical skills are still important for the PM of the owner's consulting firm but, more importantly, soft skills such as communication matter in the selection of the most qualified consultants. The PM needs to be diplomatic in negotiating on behalf of the owner with various parties involved in the project. The PM needs to have a broad view of all the disciplines involved in the project. Knowledge of engineering design practices is important but should be complemented with the ability to address unique challenges of construction project management and integration with operations and maintenance requirements of the project.

Most of the DOTs are looking for soft skills such as the ability to manage conflicts and negotiate with different parties for candidates in these positions. The PM should be comfortable communicating effectively with a wide range of agencies, firms, and people to achieve the best from the project for the owner. Diplomatic skills are tremendously helpful to reduce the chance of any conflicts and disputes that can delay the smooth progress of the project.

For instance, VDOT besides having specific technical requirements from the personnel, explicitly mentions in the contracts that the consultant's key personnel should be permanently assigned to the contract. This means that all the individuals identified as key personnel should remain on the consultant's team for the duration of the contract.

1.15.6 Conflicts of Interest (COIs)

It is a common practice among all the state DOTs that the prime owner's consultant firms are precluded from being involved in the design–builder's or the developer's team. Some state DOTs even preclude the consulting firms to propose on the other consulting contracts with the state related to innovative delivery projects. There are some exceptions, as in TxDOT a firm which proposed for either PMC or GEC tasks can propose for both of the contracts if the core team in each contract is different. Some state DOTs are more flexible in allowing the consulting firm to compete in design–build teams. For instance, CDOT allows the consultant that has been involved in less than 20 percent of the tasks to bid for the same project as a part of the design–build team. However, some state DOTs, like GDOT, UDOT and Caltrans, are more restricted and do not let the consultant compete on any DB projects in the state. Restrictions are typically much harder for consulting firms

that have program management roles at the high level to oversee the entire state design–build program. General engineering consulting firms that just perform specific engineering design tasks can compete on other design–build projects.

Also, consulting firms and state DOTs’ staff need to adhere with the state laws and regulations related to the use of former state DOT employees in the consulting team. The prime consultant is responsible to reveal any possible sources of COI and understands that the best approach is not to hide any possible issues in the submission. The state DOT also needs to make sure that enough firewalls are placed to implement a fair and consistent selection process. For example, NCDOT, MnDOT, UDOT, TxDOT and Caltrans all mention in their contracts that the consultant firms are not allowed to be a part of design-build team.

1.15.7 Disadvantaged Business Enterprise (DBE)

The U.S. Department of Transportation (U.S. DOT) is dedicated to serving the community, including those businesses contracting with state agencies and recipients of DOT funds. The Department’s Disadvantaged Business Enterprise (DBE) program is designed to remedy ongoing discrimination and the continuing effects of past discrimination in federally assisted highway, transit, airport, and highway safety financial assistance transportation contracting markets nationwide. The primary remedial goal and objective of the DBE program is to level the playing field by providing small businesses that are owned and controlled by socially and economically disadvantaged individuals a fair opportunity to compete for federally funded transportation contracts. State DOTs highly encourage the consulting firms to utilize DBEs in various capacities throughout the

development of design–build and P3 programs. Most DOTs set DBE goals for owner’s consulting firms in design–build and P3 services. Also, most state DOTs provide training opportunities for DBEs and assist them in connecting with national and large consulting firms on design–build initiatives. Some state DOTs provide mandates in their consulting contracts to allocate several types of work items to small firms, especially DBEs. This approach tries to avoid concentration of DBE services and helps widen the breadth of specialty firms involved in the consulting works. Some state DOTs request the prime consulting firm to provide specific rates for the all sub-consultants in the team, especially the DBE members. In some cases, the state DOT audits DBEs’ invoices and evaluates the authenticity of paychecks to DBE members of the team.

For Example, Caltrans set an 8 percent goal in its agreement with DBE firms. If DBE sub-consultant is terminated or fails to complete its work for any reason, the consultant will be required to replace that original DBE sub-consultant with another DBE sub-consultant. The DBE cannot be replaced without receiving a formal notice from Caltrans.

Another example with a unique approach is FDOT. The department has contracted with a consultant, referred to as the DBE supportive services provider, to provide managerial and technical assistance to DBEs. This consultant is also required to work with prime design–build firms, who have been awarded contracts, to assist in identifying DBEs that are available to participate on the project. The successful design–build firm should meet with the DBE supportive services provider to discuss the DBEs that are available to work on this project.

1.15.8 Performance Metrics

To the best of the researchers' knowledge, none of the state DOTs interviewed in this research has any systematic approach to evaluate the performance of owner's consulting firms in design–build programs. There is not a defined set of metrics that any state DOTs have developed to measure the performance of the consultant firm. This is an area where further research is deemed appropriate. In fact, some state DOTs have issued a specific task order for the consulting firm to develop a list of performance metrics for their works that the state DOT could use to evaluate their performance. This task order is considered under the high-level advisor and policy development role of the consulting firm. As biased as this approach might be, this may be the only approach that some state DOTs currently use amid their limited in-house expertise in performance evaluation.

State DOTs can begin looking into their RFQs to reassess how the most qualified consultants are selected and what role past performance plays in the selection criteria. Timeliness, quality of services, price stability, and business relations are among the important areas that can be initially used to quantify the past performance of consulting firms. Specific metrics can be developed under these areas for design–build programs. Measuring the performance and keeping track of it can help state DOTs in future selection processes and benefit the consulting industry as an appropriate lesson-learned tool.

The bottom line is that the consulting industry correctly understands that superior performance is absolutely critical in securing future businesses with the client. Anything short of superseding the state DOT's expectations is not an option for the consulting firm, as prior experience is the most critical evaluation factor used by state DOTs to shortlist and

select the owner's consulting firm in design–build programs. Internal incentives, such as reputation and higher likelihood of becoming successful in future consulting contracts are appropriate mechanisms to motivate consulting firms to perform the best they can in their services to assist the owner in managing design–build programs.

SUMMARY OF THE STUDY

This research provides a synthesis of practices in organizational structuring and professional staffing of the innovative delivery units in several state DOTs across the nation that are actively utilizing alternative project delivery. Subject matter experts, who were surveyed by email or interviewed by telephone, identified several major challenges and barriers faced by innovative project delivery units in fulfilling project leadership staffing needs.

Also, various approaches that state DOTs have utilized to respond to their staffing and organizational needs are identified. Organizational structure of a state DOT, regulating legislations and policies, history and culture of the organization, and the design–build industry in the state are among the most important factors that affect the approach the state DOT utilizes to professionally staff its innovative delivery program.

The results of email surveys, structured interviews, and content analysis of several documents help better understand various models utilized by different state DOTs in managing the workload for design–build (DB) and public–private partnership (P3) programs. Differences in organizational structuring and professional staffing for innovative project delivery programs are described in the following areas:

- Models of Office of Innovative Delivery
- Main Roles and Responsibilities of the Headquarter (HQ) Office of Innovative Delivery
- Involvement of District Offices in Delivery of Design–build Projects

- Training and Staffing Strategies and Preferred Skillsets
- Utilizing Consulting Firms to Assist the Owner
 - Prequalification, Licensing Requirements, and Selection Criteria for Evaluating Consulting Firms (Licenses, Requirements)
 - Selection Process
 - Contracting and Payment Methods
 - Assigned Tasks to the Owner's Consulting Firm
 - Key Personnel and Respective Required Skillsets and Qualifications for Owner's Consultants
 - Conflicts of Interest (COIs)
 - Disadvantaged Business Enterprise (DBE)
 - Performance Metrics

REFERENCES

- A Guide to the Project Management Body of Knowledge” published by the Project Management Institute (www.pmi.org).
- Amekudzi-Kennedy, A., and Akofio-Sowah, M.-A. (2016). “Title: Review and Business Case Analysis of Transportation-STEM Programs with State DOT 1 Involvement 2 3.”
- Behrens, M. W., Campbell, S. C., Carlson, E. D., Craig, J. L., Hungerbeeler, H. L., Dot, M., Kanafani, A. K., Meyer, M. D., Morales, J. P., Skoutelas, P. P., Wickham, M. W., and Kirk, R. S. (n.d.). *NCHRP 313 - State DOT Outsourcing and Private-Sector Utilization. Georgia Regional Transportation Agency JOHN M. SAMUELS, Senior Vice President.*
- Federal Highway Administration (FHWA). (2015). Design-Build Project Delivery Defined. http://www.fhwa.dot.gov/ipd/p3/defined/design_build.aspx
- Federal Highway Administration (FHWA). (2017). Consultant Services Procurement, Management, and Administration of Engineering and Design Related Services—Questions and Answers Section VIII. <https://www.fhwa.dot.gov/programadmin/172qa.pdf>
- Federal Highway Administration (FHWA). (2017). Defining "Responsible Charge" in the Federal-aid Highway Program. <https://www.fhwa.dot.gov/federalaid/110804.cfm>
- Gransberg, D., and Molenaar, K. (2008). “Does Design-Build Project Delivery Affect the Future of the Public Engineer?” *Transportation Research Record: Journal of the Transportation Research Board*, Transportation Research Board of the National Academies , 2081, 3–8.
- Pakkala, P. (2002). *Innovative Project Delivery Methods for Infrastructure An International Perspective.*
- Taylor, T. R. B., and Maloney, W. F. (2013). *Forecasting Highway Construction Staffing Requirements. NCHRP Synthesis of Highway Practice.*
- Warne, T. (2005). “NCHRP Project 20-24(50) In-Service Training Needs for State

DOT's.”

WARNE, T. R. (2003). *Recruiting and Retaining Individuals in State Transportation Agencies* - Thomas R. Warne, National Cooperative Highway Research Program - Google Books.

U.S. Department of Transportation (2017), Disadvantaged Business Enterprise (DBE) Program <https://www.transportation.gov/civil-rights/disadvantaged-business-enterprise>